Supplemental Specification
2005 Standard Specification Book

SECTION 02633

CONCRETE DRAINAGE STRUCTURES

Add Section 02633:

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing concrete drainage structures from the CB and DB Series Standard Drawings.

1.2 RELATED SECTIONS

A. Section 01721: Survey

B. Section 02324: Compaction

C. Section 02635: Grates, Solid Covers, Frames, and Manhole Steps

D. Section 03055: Portland Cement Concrete

E. Section 03056: Self-Consolidating Concrete (Special Provision)

F. Section 03152: Concrete Joint Control

G. Section 03211: Reinforcing Steel and Welded Wire

H. Section 03310: Structural Concrete

I. Section 03390: Concrete Curing

1.3 REFERENCES

A. AASHTO M 198: Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

B. AASHTO M 199: Precast Reinforced Concrete Manhole Sections

C. AASHTO M 213: Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

D. AASHTO M 235: Epoxy Resin Adhesives

E. AASHTO M 315: Joints for Circular Concrete Sewer and Culvert Pipes Using Rubber Gaskets

F. AASHTO Standard Specification for Highway Bridges

G. ASTM C 361: Standard Specification for Reinforced Concrete Low-Head Pressure Pipe

H. ASTM C 443: Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

I. ASTM C 478: Precast Reinforced Concrete Manhole Sections

J. ASTM C 857: Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

K. ASTM C 858: Standard Specification for Underground Precast Concrete Utility Structures

L. ASTM C 891: Installation of Underground Precast Concrete Utility Structures

M. ASTM C 1107: Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

N. ASTM C 1244: Standard Test Method for Concrete Sewer Manholes by Negative Air Pressure (Vacuum) Test Prior to Backfill

O. UDOT Quality Management Plans

1.4 DEFINITIONS

A. This specification is applicable for the following defined products:
   1. Catch Basin/Drop Inlet: A structure accepting drainage from gutters or medians or other channels and discharging the water through a conduit. Refer to the CB and DB Series Standard Drawings for shape and dimensions of Standard Catch Basins.
   2. Inlet: A grated surface connection to a closed conduit such as a storm drain. A structure at the upstream end of a cross culvert. The upstream end of any structure through which water may flow.

3. Manhole (access hole): A circular structure for access and joining pipes. Refer to the CB Series Standard Drawings for the Standard Detail for a Manhole.

1.5 SUBMITTALS

A. Submit concrete mix design for approval in accordance with Section 03055 or 03056 (Special Provision).

B. Precast structures:
   1. Provide verification the structures are furnished by a Department pre-qualified precast supplier.
   2. Submit a Certificate of Compliance from UDOT Central Materials upon delivery to the project.

1.6 ACCEPTANCE

A. Construct cast-in-place or install precast drainage structures meeting the requirements of this section and all other applicable requirements.

B. Repair or replace any structure that has the following:
   1. Fractures or cracks passing through the wall, except for a single end crack that does not exceed the thickness of the precast unit.
   2. Defects showing improper proportioning, mixing, or molding.
   3. Honeycombing and open texture.
   4. Damaged or cracked ends that prevent joining manhole/inlets grade rings and sections.
   5. Any continuous crack having a surface width of 0.01 inch or more that extends more than 12 inches anywhere on the wall.
   6. For grade rings or similar structures limit cracks or fractures according to ASTM C 478.

   Submit repair procedure to the Engineer for approval prior to performing any repairs.

C. Precast structures:
   1. Furnish precast drainage structures in conformance with the CB Series Standard Drawings.
      a. Pre-qualify the supplier in accordance with the UDOT Quality Management Plan: Precast/Prestressed Concrete Structures.
      b. Furnish precast structures that are plumb and square within 1/8 inch per foot so that precast adjoining elements fit.
      c. Mark structures with date of casting and supplier identification.

D. Upon completing each installation, and before placing backfill, obtain acceptance from the Engineer.
   1. Verify the structures and pipe connections appear watertight.
   2. When directed by the Engineer, test in accordance with this Section, article 3.3.

PART 2 PRODUCTS

2.1 CONCRETE

A. Wet cast: Class AA-AE, see Section 03055.

B. Dry cast: Submit mix design for approval.
   1. Minimum cement content: 470 lb/yd^3
   2. Maximum water/cementitious ratio: 0.4

C. Self-Consolidating Concrete: Follow Section 03056 (Special Provision).

2.2 REINFORCING STEEL AND WELDED WIRE

A. Refer to Section 03211.

B. Use coated reinforcing steel.

2.3 STRUCTURAL CONCRETE

A. Refer to section 03310.

2.4 JOINTS AND SEALERS

A. Preformed Joint Filler: AASHTO M 213 and AASHTO M 198.

2.5 WATERSTOPS

A. Refer to Section 03152 for materials requirements.

B. Refer to AASHTO Standard Specification for Highway Bridges, Division II, Subsection 8.9.3.4 for installation requirements.

2.6 NON-SHRINK GROUT

A. Use non-shrink grout conforming to ASTM C 1107.

2.7 CURING COMPOUND

A. Refer to Section 03390.

2.8 FORMS

A. Use plywood, wood, metal, glass, or a combination of these materials.

2.9 GASKETS AND JOINT SEALANTS FOR CONNECTING PRECAST SECTIONS

A. Furnish gaskets for sealing precast sections that meet ASTM C 443 requirements.

B. Furnish gaskets for sealing precast concrete manholes that meet AASHTO M 315.

C. Furnish epoxy resin adhesive according to AASHTO M 235.

D. Furnish "O" Ring per ASTM C 361 as shown in the CB Series Standard Drawings.

2.10 MANHOLE/FRAME GASKET

A. Place ¾ inch diameter minimum extruded rope Type B flexible plastic gaskets between the manhole frame and the concrete risers that meet AASHTO M 198 requirements.

2.11 JOINTING MASTIC

A. Furnish a water resistant elastic jointing mastic of plastic bituminous materials and inert fillers that when applied to a vertical metal surface and heated to 120 degrees F does not loose slump or plasticity.

B. Furnish joint mastic that can be applied evenly and adhere at temperature range of 40 to 120 degree F or higher.

2.12 GRATES, SOLID COVERS, FRAMES, AND MANHOLE STEPS

A. Refer to Section 02635.

PART 3 EXECUTION

3.1 PREPARATION

A. Before manufacturing or constructing any structure, verify and ensure fit and function with field conditions. Refer to Section 01721.

B. Furnish structures free of voids, cracks, and with beveled corners and edges. Securely attach all inserts in the proper location. Prevent cold joints in the structure.

C. Clean and prepare the mating surfaces before assembly of pipes with structure.
   1. For precast, use one of the following methods to connect the pipe(s) to the structure:
      a. Pipe boot according to pipe manufacturer specifications for pipe type.
      b. Non-shrink grout to seal the pipe connection.

D. Excavate the material under the box location to a minimum depth of 4 inches, and backfill with suitable backfill material and compact.
   1. Excavate sufficiently to place and compact bedding and backfill material in accordance with Section 02324.
   2. Add as needed a sand-leveling course no greater than 2 inches in depth to the backfill material. When used, excavate the area to the appropriate depth to accommodate the backfill and leveling course.

3.2 INSTALLATION

A. Manholes: Furnish precast concrete manholes that conform to CB Series Standard Drawings, meet ASTM C 478 requirements, and have self-centering watertight joints that meet ASTM C 443 requirements.

B. Grade Rings/Catch Basin Grade Sections: Furnish grade rings or catch basin grade adjustment according to ASTM C 478, with anchor bolt-holes as shown on the CB Series Standard Drawings.

C. Precast Inlets and Boxes:
   1. Furnish structures conforming to CB Series Standard Drawings.
      a. Attach and secure all inserts at the place of manufacture such as wall sleeves, gaskets or piping, sumps, steps, access hatches, and any other inserts as shown on the plans or CB Series Standard Drawings.

2. Manufacture structures according to applicable requirements of ASTM C 858, and as modified by this Section.
    a. Meet AASHTO M 199 and ASTM C 857 requirements.
3. Provide sufficient lifting points for a safe installation.
    a. Locate lifting devices to avoid interference with the reinforcing steel.
4. Do not move precast units until after 28-day compressive strength has been attained.
    a. Protect the unit from any damage. Replace unacceptable units at no additional cost to the Department.
5. Follow ASTM C 891. Comply with manufacturer installation guidelines.
    a. Inspect precast drainage structures for defects before lowering into excavation.
    b. Clean mating surfaces of all foreign materials such as dirt, mud, stones, etc. and apply proper joint sealing material where applicable.
    c. Assemble all joints tightly.
    d. Use care when joining precast elements in cold weather. Do not force joints together with mechanical equipment. Sufficiently warm all sealing materials to flow without causing damage to precast joint elements.
6. Furnish structures with appropriate openings for connecting pipe.
    a. Cast or cut structure openings. Do not expose reinforcing steel or reduce reinforcing steel covering at openings.
    b. Do not modify precast units in the field by cutting or enlarging holes or by making any other changes without the manufacturer's and Engineer's approval.
    c. Modify precast units only according to manufacturer requirements.
7. Do not place precast drainage structure in excavation that has water and frozen surfaces.
8. Plug lift insert recesses with a 1:1 sand to cement grout mix. Finish flush with top and/or bottom surface of concrete.

3.3 TESTING

A. At the direction of the Engineer, upon failure of the visual inspection referenced in this Section, article 1.6, conduct either of the following tests to verify the drainage structures are watertight. Furnish all necessary equipment and materials. Repair and re-test at no additional cost to the Department any structures that fail any tests. Do not conduct Vacuum and Ex-filtration tests concurrently.

B. Vacuum Test: Follow the test procedure outlined below:

1. Vacuum test precast structures after assembly and prior to backfilling.
    a. Form a seal between the vacuum base and the manhole rim/precast structure cover. Secure pipe plugs to prevent movement while the vacuum is drawn.
    b. Draw a vacuum of 10 inches of mercury (Hg). Record the time for the vacuum to drop to 9 inches.
    c. Passing drop rates for the time to drop to 9 inches are as follows:

Diameter/Width	Time to Drop 1 inch Hg
up to 4 ft.	30 seconds
up to 5 ft.	40 seconds

    d. Make necessary repairs if the structure fails the test. Repairs and repair procedures must be acceptable to the Engineer.
    e. Disassemble the manhole and replace the gaskets if preformed plastic gaskets are pulled out during the vacuum test.

C. Ex-filtration Test: Follow test procedure ASTM C 1244 as modified below:

1. Plug all pipes leading into or out of the precast structure for a watertight seal.
2. Fill precast structure with water to a level three to four inches below the casting rim or lid.
3. Let the water stand for two-hours prior to beginning the test to allow absorption into the precast structure.
4. After the two-hour stabilization, place additional water to bring the water level back to three to four inches below the rim or lid.

5. Test for at least 2 hours and verify the leakage is less than shown on table 1.

Table 1

Precast Structure Ex-Filtration Test – Allowable Leakage						
Water Depth (measured from invert to water level)	**Allowable water drop per hour**					
(feet)	Maximum Horizontal Internal Dimension					
	4 ft.*		5 ft *		6 ft *	
	(gals)	(inches)	(gals)	(inches)	(gals)	(inches)
2	0.8	0.32	1.0	0.40	1.2	0.48
4	1.6	0.64	2.0	0.8	2.4	0.96
6	2.4	0.96	3.0	1.21	3.6	1.45
8	3.2	1.29	4.0	1.61	4.8	1.93
10	4.0	1.61	5.0	2.01	6.0	2.42
12	4.8	1.93	6.0	2.42	7.2	2.90
14	5.6	2.25	7.0	2.82	8.4	3.38
16	6.4	2.58	8.0	3.22	9.6	3.87
18	7.2	2.90	9.0	3.63	10.8	4.35
20**	8.0	3.22	10.0	4.03	12	4.84
* Adjust volume loss proportionally for different size not shown ** For greater depths provide an engineering analysis for equivalent ex-filtration rates.						

D. The Department will reimburse the Contractor for the actual cost of testing, not to exceed $500 per test, for each test required by the Engineer meeting vacuum or exfiltration requirements.

END OF SECTION